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Recognizing the rapidly decreasing availability of disposal sites on land, in 1993 Congress directed the Department of Defense to assess the technical and scientific feasibility of isolating contaminated dredged material on the abyssal seafloor. The Naval Research Laboratory (NRL) conducted and managed the assessment, which was funded during its first year by the Strategic Environmental Research and Development Program and in the following two years by the Defense Advanced Research Projects Agency. NRL carried out the projects in collaboration with participants from academic institutions and industrial organizations.

The seafloor isolation concept is an attractive management option for contaminated dredged material because, if abyssal isolation is feasible and environmentally sound, air, land, or water supplies would not be contaminated. The participants concluded that it is technically and environmentally feasible. In ports where shipping costs are high, abyssal seafloor isolation is a cost-competitive strategy. They also outlined the architecture of a system to monitor conditions at the site and to detect and measure possible leaks of contaminated material.

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Contaminated Sediments News

Issue 22 - Fall 1998

Welcome to *Contaminated Sediments News (CSNews)* Online Edition. *CSNews* is produced by the EPA Office of Science and Technology (OST) with the purpose of exchanging information on contaminated sediments and to increase communication among interested parties. To obtain copies of this report or to contribute information, please contact Jane Marshall Farris, EPA OST, Mail Code 4305, 401 M Street SW, Washington, DC 20460, (202) 260-8897, E-mail: FARRIS.JANE@epamail.epa.gov. To be added to the mailing list or to make corrections/changes to your address, please fax your request to Jane Marshall Farris at (202) 260-9830.

INSIDE.....

EPA's *Contaminated Sediment Management Strategy* Published

To address the ecological and human health risks that contaminated sediment poses in many U.S. watersheds, the Agency has published EPA's Contaminated Sediment Management Strategy. Also available for review, through the Office of Water Docket (202 260-3027), is the Response to Public Comments Document.

The Strategy is an EPA workplan describing actions the Agency believes are needed to bring about consideration and reduction of risks posed by contaminated sediments. In it, EPA summarizes its understanding of the extent and severity of sediment contamination, including uncertainties about the dimension of the problem and describes the cross-program policy framework in which EPA intends to promote consideration and reduction of ecological and human health risks posed by sediment contamination.

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The Strategy establishes four goals:

1. To control sources of sediment contamination and prevent increases in the volume of contaminated sediment.
2. To reduce the volume of existing (in-place) contaminated sediment.
3. To ensure that sediment dredging and dredged material disposal are managed in an environmentally sound manner.
4. To develop a range of scientifically sound sediment management tools for use in pollution prevention, source control, remediation and dredged material management.

EPA's Contaminated Sediment Management Strategy sets forth a plan to accomplish a number of key actions.

- Agency programs will use consistent and scientifically sound sediment assessment methods in their prevention or remediation processes.
- Agency programs will use the first National Sediment Quality Survey Report to Congress (EPA 823-R-97-006) and future biennial updates to target chemicals and watersheds for further assessment, pollution prevention, and remediation.
- Where watersheds are clean, EPA will prevent sediment contamination through point and nonpoint source controls, promoting best management practices, and by testing new pesticides and other chemicals to ensure that they will not contaminate sediment.
- Where watersheds are being contaminated, EPA will take appropriate action through its point and nonpoint source control programs to reduce or eliminate contaminant inputs.
- Where watersheds are already contaminated, EPA will develop risk management strategies and implement source controls.

Copies of EPA's Contaminated Sediment Management Strategy (document number EPA-823-R-98-001) are available from:

U.S. Environmental Protection Agency
National Center for Environmental Publications and Information
11029 Kenwood Road., Building 5
Cincinnati, Ohio, 45242.

Copies may be ordered by phone at (800) 490-9198; by fax at (513) 489-8695; or on the Internet at http://www.epa.gov/ncepihom/orderpub.html. The Strategy can be viewed or downloaded from the Office of Science and Technology's home page, at http://www.epa.gov/ost.

Study of Abyssal Seafloor Isolation of Contaminated Sediments Concluded

Recognizing the rapidly decreasing availability of disposal sites on land, in 1993 Congress directed the Department of Defense to assess the technical and scientific feasibility of isolating contaminated dredged material on the abyssal seafloor. The Naval Research Laboratory (NRL) conducted and managed the assessment, which was funded during its first year by the Strategic Environmental Research and Development Program and in the following two years by the Defense Advanced Research Projects Agency. NRL

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Suitable Disposal Site Found

Material should be placed in as few sites as possible, ideally only one, to minimize the affected area. This is a major constraint. Introducing dredged material, with its high organic content, into the abyssal environment can be expected to alter the local geochemical and biological conditions for hundreds and possibly thousands of years. After extensive analysis of oceanographic, meteorologic, geologic, and economic constraints, the project team identified a suitable area in the Hatteras Abyssal Plain, about 1,600 km (992 mi.) south of Boston and 1,100 km (620 mi.) east of Jacksonville.

During its first year, the project determined that the optimal means of transporting material to the site would be large bags made of synthetic fabric that holds 400-800 cubic meters of material. Barges would haul the containers from a dredging site to the ocean isolation site, where they would be released to fall freely to the abyssal seafloor. Container walls and seams would be strong enough not to tear during release from the barge and the subsequent 5,000-meter descent and impact on the abyssal seafloor. Only one probable pathway for contaminants to enter the productive surface ecosystem was identified: the eggs of certain abyssal fish. However, the quantity of transport would be negligible.

Monitoring System Designed

In the last year, the project has identified several types of sensors and platforms that could be used to monitor the isolation site for possible leakage. The monitoring system architecture was formulated to deploy, operate, maintain, and retrieve data from the sensor suite. This was challenging due to the levels of measurement sensitivity and the stability required in the high pressures and low temperatures of the abyssal regions.

For More Information

Findings of Years One and Two addressing the engineering system and environmental consequences of such a contaminated dredged material management concept are available in NRL reports and conference proceedings; peer-reviewed papers are in publication. Findings of Year Three will soon be published in NRL reports. For more information, contact Philip Valent of the Naval Research Laboratory at (228) 688-4650, by fax at (228) 688-4093, or by E-mail at phil.valent@ nrlssc.navy.mil.

Regional Activities

EPA Great Lakes National Program Office

Ottawa River, Ohio: Contaminated Sediment Remediation Project Completed

Concentrations of polychlorinated biphenyls (PCBs) in the sediment of a former tributary

to the Ottawa River in Toledo, Ohio are less than 10 parts per million (ppm) following completion of a $5 million remediation project in May.

The project was the result of a partnership between the City of Toledo, the Ohio Environmental Protection Agency (OEPA), the U.S. Environmental Protection Agency, and GenCorp, Inc. To help "jump start" the effort and demonstrate the effectiveness and efficiency of a partnership approach to addressing sediment contamination, U.S. EPA's Great Lakes National Program Office awarded a $500,000 grant to OEPA. An additional $140,000 came from an OEPA solid waste settlement with the City of Toledo, and approximately $4,500,000 came from GenCorp.

Part of Maumee Area of Concern

The Ottawa River flows into Maumee Bay in Lake Erie's western Basin and is part of the Maumee River Area of Concern. The remediated tributary is 975 feet long and 90 feet wide. It is located about five miles upstream from Maumee Bay. PCB concentrations in the tributary had ranged up to 74,000 ppm, and fish found in the vicinity contained PCBs at concentrations over 500 ppm. A consumption advisory for eating fish taken from anywhere in the Ottawa River, issued by the Ohio Department of Health, remains in effect.

The PCBs came from a variety of sources. The primary source was an industrial facility bordering the tributary and formerly owned by GenCorp. The facility used a heat exchange fluid that contained PCBs, and some of the PCB fluid entered the tributary. Several landfills near the tributary are also suspected sources of PCBs. Two are being remediated under the Superfund Accelerated Cleanup Model.

Assessment and Clean Up

Prior to remediation, a comprehensive assessment and characterization program delineated the boundaries of the PCB-contaminated sediment. Then, several remedial options were investigated. The chosen option called for a sheet pile coffer dam to isolate the tributary hydraulicly from the Ottawa River's main stem. Once the dam was in place, water was pumped and treated on site, and about 8,000 cubic yards of contaminated sediment were removed. The sediment was transported to a Michigan landfill licensed under the Toxic Substances Control Act. An estimated 56,000 pounds of PCBs were removed. The excavation was conducted "in the dry" to minimize any potential impacts due to resuspension of the highly contaminated sediments.

After the project was finished, the tributary was backfilled with 5 to 10 feet of clean clay, and a new swale was constructed about 100 yards to the west. The former tributary was graded and reseeded with a native wetlands seed mix. The remediation will have positive short- and long-term impacts on the Ottawa River, Maumee Bay, and Lake Erie. The cleanup has removed a major source of PCB contamination in the Ottawa River, and a significant source of contamination to Maumee Bay and Lake Erie. Fish and sediments in the Ottawa River will continue to be evaluated to monitor the reduction of exposure as a result of these remedial efforts.

For More Information

Additional information on this project is available from Marc Tuchman, Sediment Team Leader, Great Lakes National Program Office, at (312) 353-1369 E-mail: tuchman.marc@epamail.epa.gov.

EPA Region 2

Program EvaluatesTechnologies to Treat Contaminated Sediments from New York/New Jersey Harbor

More than 400 million cubic yards of sediments are dredged from U.S. waterways each year, and close to 60 million cubic yards are disposed of in the ocean. The need to protect the environment from the undesirable effects of sediment dredging and disposal is gaining increased attention from the public and government agencies.

The handling of contaminated sediments in the Port of New York/New Jersey exemplifies this problem. Each year, between 4 million and 7 million cubic yards of sediment must be dredged there to permit safe navigation and commerce. That sediment contains contaminants that are among the highest concentrations in the country. Heavy metals, chlorinated pesticides, polynuclear aromatic hydrocarbons, polychlorinated biphenyls, and dioxins/furan are the major contaminants of concern. Several contaminants detected in the sediments and in fish and shellfish have resulted in fishing advisories.

A Team Approach

The Water Resources Development Act (WRDA) of 1992 (section 405C) and 1996 (section 226) mandated a demonstration of the feasibility of decontaminating sediments from New York/New Jersey Harbor. As a result, a multicultural team was formed. It included representatives of government, industry, academia, and the general public. The WRDA Program is the responsibility of EPA Region 2 and the U.S. Army Corps of Engineer's New York District. The Department of Energy's Brookhaven National Laboratory is the technical project manager.

The program has progressed through demonstrations of various technologies at the bench and pilot scales and is now moving toward the construction of commercial-scale facilities. This step-wise procedure has reduced the number of participants through specific selection criteria, including technical performance, demonstration costs, public-private cost sharing, beneficial reuse of treated material, and corporate evaluations of the business potential for sediment decontamination.

Federal funding available under WRDA provides assistance to the commercialization process, but the private sector will provide the capital needed for facility construction and operation. The program participants believe this type of cooperative approach will be useful in the New York and New Jersey region—and may have features of interest to other U.S. ports that must dispose of contaminated sediments.

Dumping Options Dwindle

Stricter regulations have reduced the amount of dredged material considered suitable for dumping in the coastal Atlantic Ocean, thus creating an operational crisis for the New York/New Jersey Harbor. On September 29, 1997, EPA de-designated and terminated the dredged material ocean disposal site and simultaneously designed the Historic Area Remediation Site (HARS). The HARS can receive only dredged material suitable for use as "Material for Remediation," defined as "uncontaminated dredged material (i.e., dredged material that meets current Category I standards and will not cause significant undesirable effects, including those caused by bioaccumulation)."

Current proposed solutions to the port's dredged material disposal problem include:

- Continued unrestricted ocean disposal of uncontaminated material to the HARS.
- The use of confined disposal facilities (both upland facilities and containment islands).
- Subaqueous borrow pits.
- Processing/treatment of contaminated materials.

A complete solution to the dredging problem will likely include a combination of many, or all, of these alternatives. Decontamination is one component of the overall dredged material management strategy. It can reduce the magnitude of the contamination, and may provide a treated product that can be sold for reuse, thus simplifying disposal and possibly reducing the overall cost of treatment.

Seeking Economic Alternatives

Goals of the WRDA Program include demonstrating sediment decontamination technologies and creating a treatment train capable of annually processing as much as 500,000 cubic yards of contaminated sediment. This treatment train includes sediment assessment (3-D sediment visualization), dredging, materials handling, decontamination and beneficial reuse of the post-treated material.

Bench- and pilot-scale tests of various technologies were completed in December 1996. The technologies included thermal destruction and desorption processes, stabilization/solidification, sediment washing, advanced chemical treatments, solvent extraction methods, and manufactured soil production. The development of an overall conceptual plan for implementing a large-scale facility is underway.

Various contaminants are present at a wide range of concentrations in material dredged from the New York/New Jersey Harbor. This fact necessitated the development of several types of decontamination technologies to provide comprehensive treatment. In each case, the processed materials have beneficial uses and can be sold to offset a portion of the decontamination costs.

In 1998, the WRDA Program is focusing on a system of low- to high-temperature technologies that can accommodate a range of sediment contamination. These approaches include a sediment washing method developed by BioGenesis Enterprises, Inc., a high-temperature process developed by the Institute of Gas Technology (IGT) to destroy organic compounds and bind metals into a cementitious matrix, and a Westinghouse plasma-arc vitrification process. Work also is being done on manufactured soil production; the U.S. Army Corp of Engineers Waterways Experiment Station is using untreated sediment for that purpose, and BioGenesis is looking at using treated sediment from the harbor.

Beneficial Uses

The material dredged from the New York/New Jersey Harbor consists mainly of fine-grained silt and clay, and is unsuitable for use as structural fill directly after treatment. Because treatment destroys naturally occurring organic material as well as organic contaminants, the treated material typically is not a useful growth substrate. However, the treated material can be mixed with other material to make a variety of useful products, including potting soil, top soil, and daily landfill cover. It also can be used in wetlands and habitat restoration, and in the restoration or filling of underwater areas.

The blended cement produced by the IGT high-temperature Cement Lock™ Technology exceeds the American Society for Testing and Materials requirements for portland cement. It can be used in concrete for general construction applications.

Anticipated Commercial Operation

The large-scale treatment facilities that will meet the WRDA treatment goal are expected to become operational in 12 to 30 months. But before they begin operating, they must obtain state and local permits. The permit process for sediment washing should be relatively straightforward, since there are no gaseous sidestreams, and contaminants found in a liquid side stream can be removed by standard water processing techniques. The high-temperature process, however, will require comprehensive air permits.

Environmentally safe decontamination technologies also must be economically viable. Currently, dredged material is stabilized with fly ash and used for construction material and cover at several locations in New Jersey. The total cost of dredging, stabilization, and disposal ranges from $40 to $50 per cubic yard. Current disposal costs in the Newark Bay confined disposal facility are about $35 per cubic yard.

WRDA Program managers are confident that costs of sediment washing and cement production will be competitive—at or below $35 per cubic yard—when full-scale operation is underway.

For More Information

More information is available from Eric A. Stern of EPA Region 2, 290 Broadway, New York, NY 10007-1866. His phone number is (212) 637-3806, and his E-mail address is stern.eric@epamail.epa.gov.

Editor's Note: This article is based on the paper "Maintaining Access to America's Intermodal Ports/Technologies for Decontamination of Dredged Sediment: New York/New Jersey Harbor," by Eric A Stern, EPA Region 2; Keith W. Jones, Brookhaven National Laboratory; Kerwin Donato, U.S. Army Corps of Engineers - New York District; John D. Pauling, P.E., and John G. Sontag, Jr., P.E., Roy F. Weston, Inc.; Nicholas L. Clesceri, Rensselaer Polytechnic Institute; Michael C. Mensinger, ENDESCO Services, Inc.; and Charles L. Wilde, BioGenesis Enterprises, Inc.

UC Berkeley Researchers Use *In Vitro* Technique to Measure Bioavailability of Sediment-Associated Contaminants

Researchers at the University of California at Berkeley are using in vitro digestive fluid extraction to measure sediment-bound contaminant bioavailability. The original description of the technique (Mayer et al., 1997) and further development (Weston and Mayer, 1998a; 1998b) have shown the approach provides a measure of the bioavailability of sediment contaminants in a wide variety of risk assessment scenarios and can be used to study the basic mechanisms of how organisms accumulate contaminants from sediments.

When a deposit-feeding organism ingests sediment, the chemistry of the gut environment determines if the associated contaminants can be desorbed from the particles and are available for dietary absorption. The researchers mimic this process in vitro, by incubating the sediments of concern in digestive fluid and expressing bioavailability as the percentage of contaminant solubilized in those fluids.

The approach presumes that the contaminant extractable by digestive fluid is implicitly a

far better indicator of the bioavailable fraction than that extractable by the strong acids or exotic organic solvents typically used in a chemical analysis. Chemical extraction methods are generally designed to recover the total, rather than the bioavailable, contaminant. Some proposed selective extractions (for example, a weak acid extraction for trace metals) purport to quantify the bioavail-able fraction, but none have been generally accepted or broadly adopted. The digestive fluid technique is essentially a chemical extraction, but with a biologically relevant extractant.

Biological methods such as toxicity or bioaccumulation testing are currently used widely to measure bioavailability, yet interpretation of the results can be confounded by factors unrelated to bioavailability. For example, toxicity can also be a function of the organism's prior acclimation or adaptation. Bioaccumulation as a measure of bioavailability is confounded by behaviors affecting exposure (such as feeding and respiration rates) as well as metabolism of the contaminant of interest.

Results

Because of its large size and the amount of digestive fluid that can be recovered, the polychaete Arenicola brasiliensis has been a source of digestive fluid for most of the UC Berkeley researchers' work. They have used this fluid to extract sediments from throughout California contaminated with polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), or trace metals. Their results have included the following observations:

- Gut fluid pH of a wide variety of invertebrates is near neutral. That raises questions about the biological relevance of the strong acid extractions used in traditional chemical analyses for metals.
- Much of the contaminant extractable by traditional chemical means is not extractable in digestive fluid. When six California sediments were spiked with PAHs, only 12 to 50 percent of the PAHs were solubilized in an in vitro digestive fluid extraction. Thus, any assessment based on total PAHs would have overestimated the risk posed by these sediments by a factor of two to eight.
- In vitro contaminant extraction is similar to that obtained in vivo. Allowing intact A. brasiliensis to feed on contaminated sediments and then analyzing the PAH content of their gut fluids produced very similar results to dissecting digestive fluid from unexposed A. brasiliensis and doing the extractions in vitro.
- Digestive fluid extraction gives results similar to other traditional bioavaila-bility measures using whole animal exposures.
- The extractability of PAH in digestive fluid is highly dependent upon the organic carbon content of the sediment. Organic carbon is widely recognized as an important determinant of bio-availability, so it is encouraging that its influence is apparent in in vitro extractions as well.
- Extraction efficiency is concentration dependent. The more contaminated a sediment is, the greater the proportion of contaminant that is bioavailable. This result is not unexpected, but it has never been tested by other bioavailability studies.
- Extending the researchers' work to include species representing several phyla clearly shows that bioavaila-bility is a concept that depends upon the exposed species. The digestive fluid of some species is capable of extracting an order-of-magnitude more contaminant from ingested sediment than is the fluid from other species.

- The approach can be used to test the effect of sediment holding time or conditions (such as freezing) on the bioavailability of sediment-bound contaminants. For example, when a sediment was spiked with PAHs and immediately extracted by digestive fluid, 70 percent of the PAHs was solubilized. Holding the sediment for three weeks cut the extractable proportion to 35 percent. Sediment aging has been shown to decrease bioavailability in a number of other bioaccumulation and microbial degradation studies as well.

Potential Applications

The in vitro digestive fluid extraction technique provides an intuitively attractive method to quantify contaminant bioavail-ability to aquatic organisms. It has obvious utility in any application where quantification of the bioavailable, rather than total, contaminant is desirable and when ingestion of contaminated sediments is a potential route of contaminant bioaccumu-lation. The approach has the ecological relevance of biologically based methods to measure bioavailability, such as bioaccumulation testing, but without some of the complications such as metabolism of the compound of interest.

Since the technique does not require exposure of whole animals, sediments can be evaluated even when conditions are unsuitable for long-term animal exposure (for example, anaerobic conditions or hypersaline environments). The approach holds great promise in studying the fundamental mechanisms of bioaccu-mulation, in establishing the effect of laboratory manipulations of sediment on bioavailability, and in ecological risk assessment of contaminated aquatic sediments.

For More Information

For more information, contact Donald Weston, University of California, 1301 S. 46th St., Bldg. 112, Richmond, CA 94804; (510) 231-5626; dweston@uclink4.berkeley.edu.

Literature Cited

Mayer, L.M., Z. Chen, R.H. Findlay, J. Fang, S. Sampson, R.F.L. Self, P.A. Jumars, C. Quetel and O.F.X. Donard. 1996. *Bioavailability of sedimentary contaminants subject to deposit-feeder digestion.* Environ. Sci. Technol. 30:2641-2645.

Weston, D.P. and L.M. Mayer. 1998a. *In vitro digestive fluid extraction as a measure of the bioavailability of sediment-associated polycyclic aromatic hydrocarbons: sources of variation and implications for partitioning models.* Environ. Toxicol. Chem. 17:820-829.

Weston, D.P. and L.M. Mayer. 1998b. *Comparison of in vitro digestive fluid extraction and traditional in vivo approaches as measures of polycyclic aromatic hydrocarbon bioavailability from sediments.* Environ. Toxicol. Chem. 17:830-840.

Participants Wanted for American Wetlands Month '99

Problem-solving workshops on such issues as how to work with developers, school projects, and other local and national wetlands concerns will dominate next spring's American Wetlands Month Conferences.

"Talking heads are out, sharing experiences and ideas are in. The American Wetlands Month Conferences give participants a chance to learn how local partnerships between businesses and environmentalists can spawn innovative solutions that are a win-win for communities and the environment," says Chris Novak, executive director of the Terrene Institute, which is sponsoring the conferences.

Conference Locations

Conferences will be held in four "Communities Working for Wetlands" from coast to coast next year.

The first conference will be held in New Orleans, Louisiana on February 18-20. The second will be in San Francisco, California on March 18-20, and the third in Indianapolis, Indiana on April 8-10. The fourth and final conference will kick off American Wetlands Month when it is held in Andover, Massachusetts on May 6-8.

Hands-on, Interactive Activities

Conference participants will actually "Work for Wetlands" on the Saturday of each conference, helping local groups with wetland projects. Optional field trips and workshops—A Wetlands Primer, Working with Corporate Partners, Landscaping Wetlands—will precede the conferences. The final reception will recognize local community leaders and groups active in wetlands conservation.

For More Information

AWM '99 Communities Working for Wetlands is cosponsored by federal agencies, private corporations, and groups. More information is available from the Terrene Institute, 4 Herbert Street, Alexandria, VA 22305; (703) 548-5473; fax on demand (800) 813-1925; Internet: www.terrene.org; E-mail: terrinst@aol.com.

CSNews Activities Timeline

1998

- *December 7-8, 1998*
  Natural Attenuation '98, sponsored by IBC, in Pasadena, CA. POC: inq@ibcusa.com

- *December 7-9, 1998*
  Environmental Biotechnologies & Site Remediation Technologies, sponsored by Institute of Gas Technology, in Orlando, FL. POC: robertsr@igt.org

- *December 9-10, 1998*
  Great Lakes GIS Online Workshop, sponsored by the Great Lakes Commission, in Chicago, IL. POC: Julie Wagemakers, 734-665-9135, juliew@glc.org

- *December 15-17, 1998*
  2nd Annual Partners for Smart Growth Conference, sponsored by USEPA and the Urban Land Institute, in Austin, TX. POC: 800-321-5011

1999

- *January 11-15, 1999*
  28th Dredging Engineering Short Course, sponsored by Center for Dredging Studies, in College Station, TX. POC: j-hyden@tamu.edu

- *January 20-22, 1999*
  Workshop on Dredged Material Management and State Coastal Zone Management Programs, sponsored by the Coastal States Organization, NOAA, and the National Dredging Team, in New Orleans, LA. POC: Tony MacDonald at CSO, 202-508-3860.

- *January 21, 1999*
  Regulation and Remedial Technologies Pertaining to Contaminated Sediments, sponsored by Federation of Environmental Technologists, in Milwaukee, WI. POC: 414-644-0070.

- *March 21-25, 1999*
  217th National Meeting, American Chemical Society, in Anaheim, CA. CALL FOR PAPERS until November 1, 1998. POC: lipnick.robert@epamail.epa.gov

- *April 11-14, 1999*
  National Conference on Environmental Decision Making, sponsored by NOEDR, in Knoxville, TN. POC: www.ncedr.org

- *April 26-30, 1999*
  Ninth International Zebra Mussel and Aquatic Nuisance Species Conference, hosted by the University of Minnesota Sea Grant Program, in Duluth, MN. ***"CALL FOR ABSTRACTS"*** until September 25, 1998. POC: Elizabeth Muckle-Jeffs, 800-868-8776 or www.zebraconf.org/

- *May 10-14, 1999*
  WEFTEC Latin America '99 in conjunction with The 20th Brazilian Congress on Sanitary and Environmental Engineering, co- sponsored by Water Environment Federation (WEF) and Associa, o Brasileira de Engenharia Sanit ria e Ambiental (ABES), in Rio de Janeiro, Brazil. POC: http://www.wef.org, E-mail: confinfo@wef.org, phone: 703-684-2442.

- *May 2-5, 1999*
  A National Town Meeting, sponsored by President's Council on Sustainable Development and Global Environment & Technology Foundation, in Detroit, MI and other locations. POC: N.M.@getf.org or www.sustainableamerica.org

- *May 17-18, 1999*
  Semi-Annual Meeting of the Great Lakes Commission, in Montreal, Quebec. POC: Contact: Mike Donahue, 734-665-9135, mdonahue@glc.org

- *May 19, 1999*
  40th Anniversary Celebration and Symposium on the Great Lakes- St. Lawrence

Seaway System, in Montreal, Quebec. POC: Mike Donahue, 734-665-9135, E-mail: mdonahue@glc.org

- *May 20-21, 1999*
  13th International Great Lakes-St. Lawrence Mayors' Conference, in Montreal, Quebec. POC: Steve Thorp, 734-665-9135, E-mail: sthorp@glc.org

- *May 19-22, 1999*
  1999 Canadian Coastal Conference, in Victoria, BC. POC: www.vgivision.com/CCC99

- *May 25-28, 1999*
  Annual Conference on Great Lakes Research, sponsored by IAGLR, in Cleveland, OH. POC: www.iaglr.org

- *May 25-28, 1999*
  Current Issues in Great Lakes Benthic Science, sponsored by the North American Benthological Society, in Duluth, MN. POC: Andy Casper, E-mail: casperaf@clarkson.edu, 315-268-3834, Internet: www.benthos.org

- *June 6-9, 1999*
  26th Annual ASCE Water Resources Planning and Management Conference,"Preparing for the 21st Century," in Tempe, Arizona, POC: http://water99.asce.org

- *June 20-24, 1999*
  4th International Symposium on Coastal Engineering and Science of Coastal Sediment Processes, in Long Island, NY. POC: www.coastalsediments.org

- *July 24-20, 1999*
  Coastal Zone '99, sponsored by NOAA, in San Diego, CA. POC: cz99@umbsky.cc.umb.edu

- *September 13-17, 1999*
  8th International Symposium on the Interactions Between Sediments and Water, sponsored by the International Association for Sediment Water Science, in Beijing, China. *"CALL FOR PAPERS"* until November 1, 1998. POC: jsc@urbanms.urban.pku.edu.cn

- *September 24-26, 1999*
  Biennial Forum on Great Lakes Water Quality, sponsored by the International Joint Commission. in Milwaukee, WI. POC: DayJ@windsor.ijc.org

2000

- *February 23-26, 2000*
  Wolves: A Global Symposium, hosted by the International Wolf Center and the University of Minnesota-Duluth, in Duluth MN. POC: merickso@d.umn.edu

- *June 21-24, 2000*
  ASCE Watershed Management 2000 Conference, "Science and Technology for the New Millennium," in Fort Collins, CO. CALL FOR PAPERS until August 31, 1999. POC: dfrevert@do.usbr.gov

This calendar is an unofficial compilation of environmental meetings, seminars, conferences, workshops, and symposia distributed over email monthly by the Corps of Engineers, Great Lakes & Ohio River Division. If you have an event to be listed, or want to be added to the distribution, send a message to: jan.a.miller@usace.army.mil

Announcements

Dredged Material Management Plan Guidance Published

The National Dredging Team announces the availability of Guidance for Local Planning Groups & Development of Dredged Material Management Plans. www.epa.gov/owow/ocpd.

An interagency group of federal agencies involved in dredged material management activities, the National Dredging Team issued this guidance to provide a framework to (1) assist in the formation of Local Planning Groups; (2) establish a planning process; and (3) develop and implement dredged material management plans.

If you have any questions, please contact Sharon Lin, Environmental Engineer, Oceans and Coastal Protection Division, U.S. Environmental Protection Agency, 401 M St. S.W. (4504F), Washington, DC 20460. Tel: (202) 260-5129; E-mail: lin.sharon@epa.gov.

1996 Annual Report on Regional Monitoring Program for Trace Substances

The San Francisco Estuary Institute's 1996 Annual Report is available for distribution. The cost is $25 ($15 for nonprofit organizations), payable by check or money order made out to the Regional Monitoring Program.

To order a copy of the report, send your payment and your name, organization, address, phone and fax numbers, and e-mail address to: Gabriele Marek; San Francisco Estuary Institute; 1325 South 46th Street; Richmond, CA 94804.

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